A-Y-K Region
Norton Sound Escapement
Report Number 21

Niukluk River Counting Tower Project
Norton Sound

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INTRODUCTION

A salmon counting tower project was initiated in 1979 on the Niukluk River approximately 20 miles northwest of Golovin (Figure 1). The Niukluk River, similar to other major rivers in Norton Sound, receives moderate runs of chum (Oncorhynchus keta) and pink (O. gorbuscha) salmon which are harvested by subsistence and commercial fishermen. To effectively manage the Norton Sound fisheries, it is important that frequent estimates of escapement during the season be obtained by either tower counts or aerial survey counts. The tower count is the more precise method and provides a check on the aerial surveys conducted.

OBJECTIVES

The 1979 Niukluk River project objectives were to:

1. Determine the feasibility of obtaining daily/seasonal timing and relative abundance data from salmon moving past the tower.
2. Determine whether tower counts on the Niukluk River can be correlated to commercial catches in Golovin Bay.
3. Determine age, sex and size structure of Niukluk River spawners.
4. Compare aerial survey totals with tower counts in order to improve survey accuracy.
5. Collect tags from fish marked in the Norton Sound Stock Separation Study.
6. Collect 500 scale samples and lengths from spawning and post spawning chum salmon in the Niukluk River.

METHODS

A portable 20 foot aluminum counting tower was erected adjacent to the river approximately one mile above the river's confluence with the Fish River (Figure 2).

A partial weir of 1 inch by 2 inch hog wire fencing was constructed in the river opposite the counting tower to divert the upstream migration of salmon towards the counting tower. The weir was supported by 7 foot steel fence stakes placed into the substrate.

A 40 by 8 foot area of river substrate was prepared adjacent to the counting tower to enhance counting visibility. Three hundred eighty four 5 gallon buckets full of white rocks passed through a 1 1/2 inch screen, were dumped onto the river bottom. Tests determined that this size reacted most favorably with river currents to maximize distribution of the material in the desired target area of river substrate.

A power line with three 400-watt incandescent light bulbs housed in 18 inch diameter reflectors were strung across the main channel to provide illumination during darkness. A 2750-watt generator provided electric current for the lights.

A 150 foot weir of hog wire fencing and spruce logs was placed across a secondary channel, formed by higher than normal water levels, to block fish passage. A gate was installed to allow fish to be passed through the weir and enumerated.

A three person crew began preliminary counting operations on July 9, and expanded to an 18 hour schedule on July 12. Each crew member counted salmon for two 3 hour shifts daily from 1200 until 0600 the next day. Hourly counts were totaled. Salmon moving downstream were subtracted

from the total count.

Ten minute counts were made at the beginning of each counting hour to determine if 10 minute counts could be used as a basis for estimating hourly migration. Ten minute counts were expanded by a factor of six to obtain an estimate of hourly migration.

Chum salmon were captured with rod and reel and length and sex data were recorded. A scale sample was taken for age analysis.

RESULTS AND DISCUSSION

Estimates of Escapements from Tower Counts

In 1979 a total of 8,213 chums and 29,100 pinks were counted past the tower (Table 1). These figures are from 18 hour counting periods and cannot be accurately expanded to the 24 hour total due to a misunderstanding between the project leader and crew leader which resulted in no 24 hour counts being made. However, data from another counting tower in Norton Sound suggests that approximately 98 percent of the chum salmon and 96.5 percent of the pink salmon migrate during the 18 hour period normally counted. Due to high water conditions, the tower was not operational until July 9. An aerial survey was performed on July 13 to determine the number of salmon already past the tower at that time. A total of 975 chum salmon were counted during the aerial survey. An additional 800 chums were passed through the weir on the secondary channel before water levels dropped enough to force salmon to use the main river channel. Final escapement totals reflecting these adjustments are 10,127 chums and 30,147 pinks.

The main peaks of the chum run occurred during the periods July 13-14 and July 20-22 (Figure 3). The daily chum run was heaviest from 1600 to 2000 hours with the largest counts occurring from 1800-1900. The

pink migration was greatest from 1600 to 2000, with the peak occurring from 1900-2000 (Tables 2 and 3).

Expanded Ten Minute Counts

Counts were totaled after the first ten minutes of each hour. Counting was then continued and the full hour count was recorded. The ten minute count was then expanded by a factor of six to obtain an hourly expanded count; each expanded hourly count was added to obtain a daily expanded count.

The chum salmon "daily expanded counts" were compared to the "actual daily counts" the maximum daily underestimate was 67% of the actual count and the maximum overage was 158% of the actual count. However, the "season expanded count" total was 8124 and the total actual counts was 8213; a 98.9% accuracy (Table 4).

The pink salmon "expanded counts" range from 29% to 141% of the actual count, however, the "season expanded count total" and the actual season total count were identical, 29,100 (Table 4).

Commercial Fishery Catches

The 1979 Golovin Bay commercial fishery caught a total of 30,201 chums and 45,948 pinks. The chum salmon catch peaked on July 29 and the pink salmon catch peaked on July 13 with consistantly high catches continuous from July 3 until the peak (Figure 3 and Table 5).

Salmon Migration Timing

Analysis of the chum salmon run timing at the commercial fishery in Golovin Bay and at the Niukluk River counting tower indicated that approximately 16 days elapsed between the peak of the commercial chum

salmon fishery and a corresponding peak in chum salmon counts past the tower (Figure 3).

A similar delay of 11 days was noted in the pink salmon run. The distance between the commercial fishing area and the tower is 35-40 miles.

A-W-L Data for Chum Salmon

Due to high water conditions and early project termination, the collection of significant numbers of scales from chum salmon carcasses was impossible. Only 29 samples were taken; 24 males and 5 females. Age and length analysis indicated the sample included 5 age 3_1, 20 age 4_1, and 4 age 5_1, chum salmon. Average length was 535 millimeters, 583 millimeters, and 626 millimeters for ages 3_1, 4_1, and 5_1, respectively.

It was not possible to gather the 500 scale samples needed for stock separation scale morphometry analysis.

CONCLUSION

The Niukluk River counting tower project successfully completed its objectives in 1979. The feasibility of obtaining accurate salmon escapement data for the Niukluk River was proved, even during a season of abnormal rains and resulting high water levels. Although the Niukluk River is not the only contributor of salmon stocks to the Golovin Bay fishery, a correlation was found between the commercial fishery peak catches and the peak tower counts. However, the extensive lag time between the exhibited peaks (about 2 weeks) would preclude management by current escapement information at the tower site.

RECOMMENDATIONS

The counting tower project on the Niukluk River should not be continued if the primary objective is to be improved in-season management of the Golovin Bay commercial salmon fishery. The counting tower can provide an accurate estimate of salmon escapement and should be continued if the Niukluk River is considered an accurate indicator of salmon escapement in the entire Fish River drainage. However, due to the general physical characteristics and configuration of the Niukluk, an acceptable estimate of escapement can be obtained by aerial survey methods at much less expense.

Management of the Golovin Bay commercial fishery can best be improved by providing accurate Fish River salmon escapement data. This information must be available either before the salmon enter the fishery or immediately after passing through it. Due to the turbid water conditions usually present in the Fish River, a counting tower close to the river mouth is not possible although a test fishing operation near the mouth (fishwheel or gillnet) or the installation of a sonar salmon counter on each bank of the lower river may be possible.

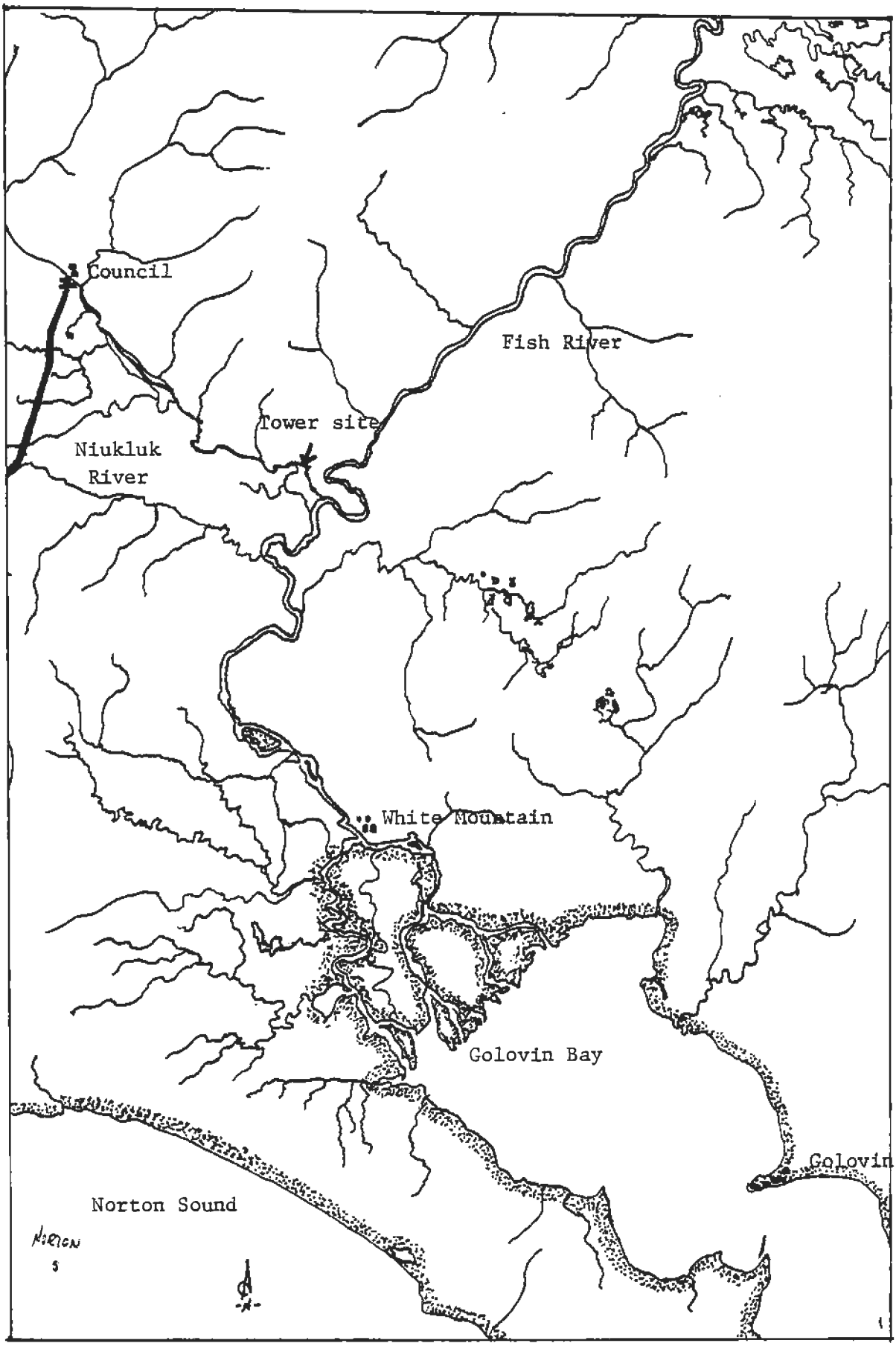

Figure 1. Vicinity map, Niukluk River counting tower, 1979.

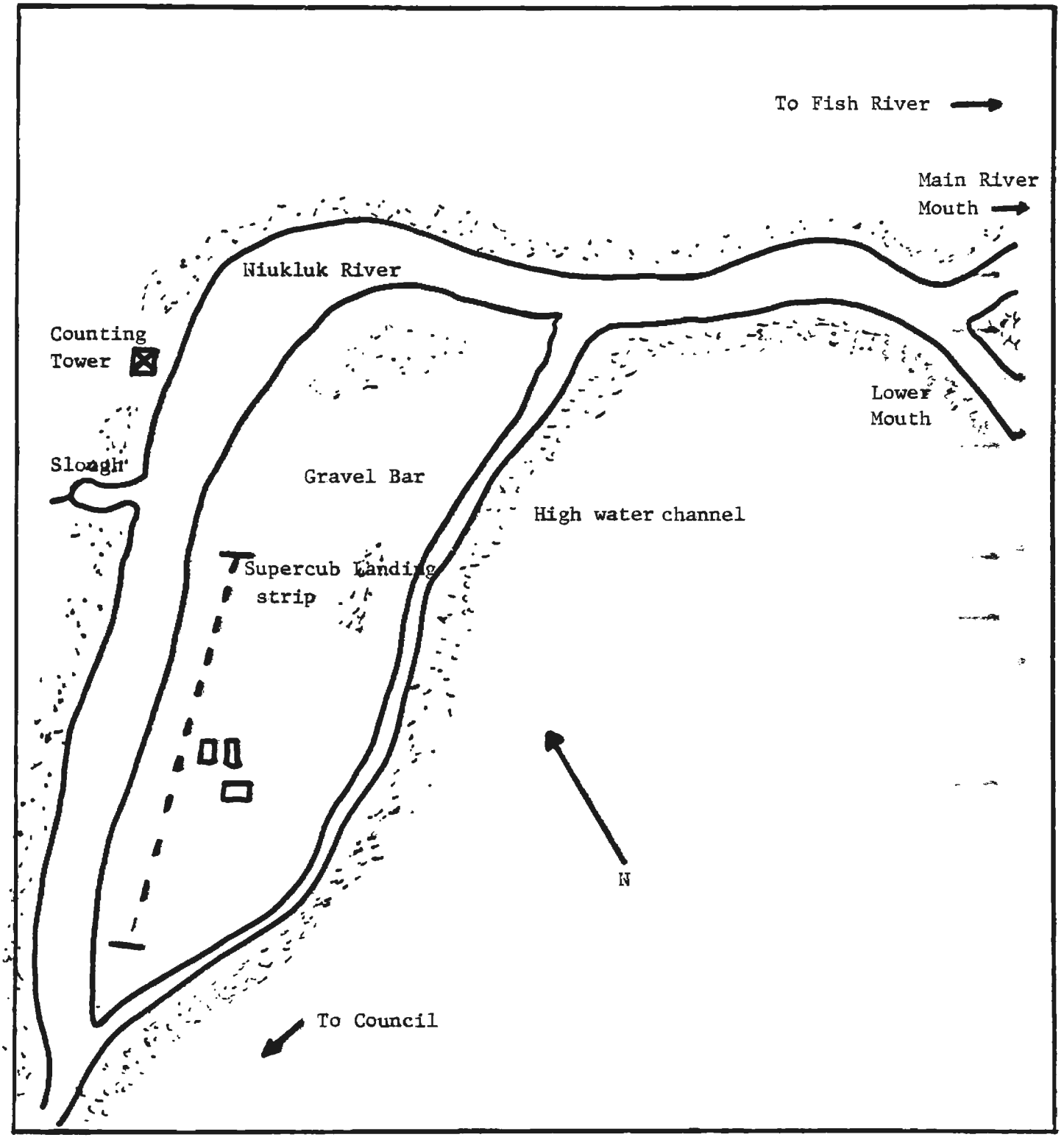

Figure 2. Location map, Niukluk River counting tower, 1979.

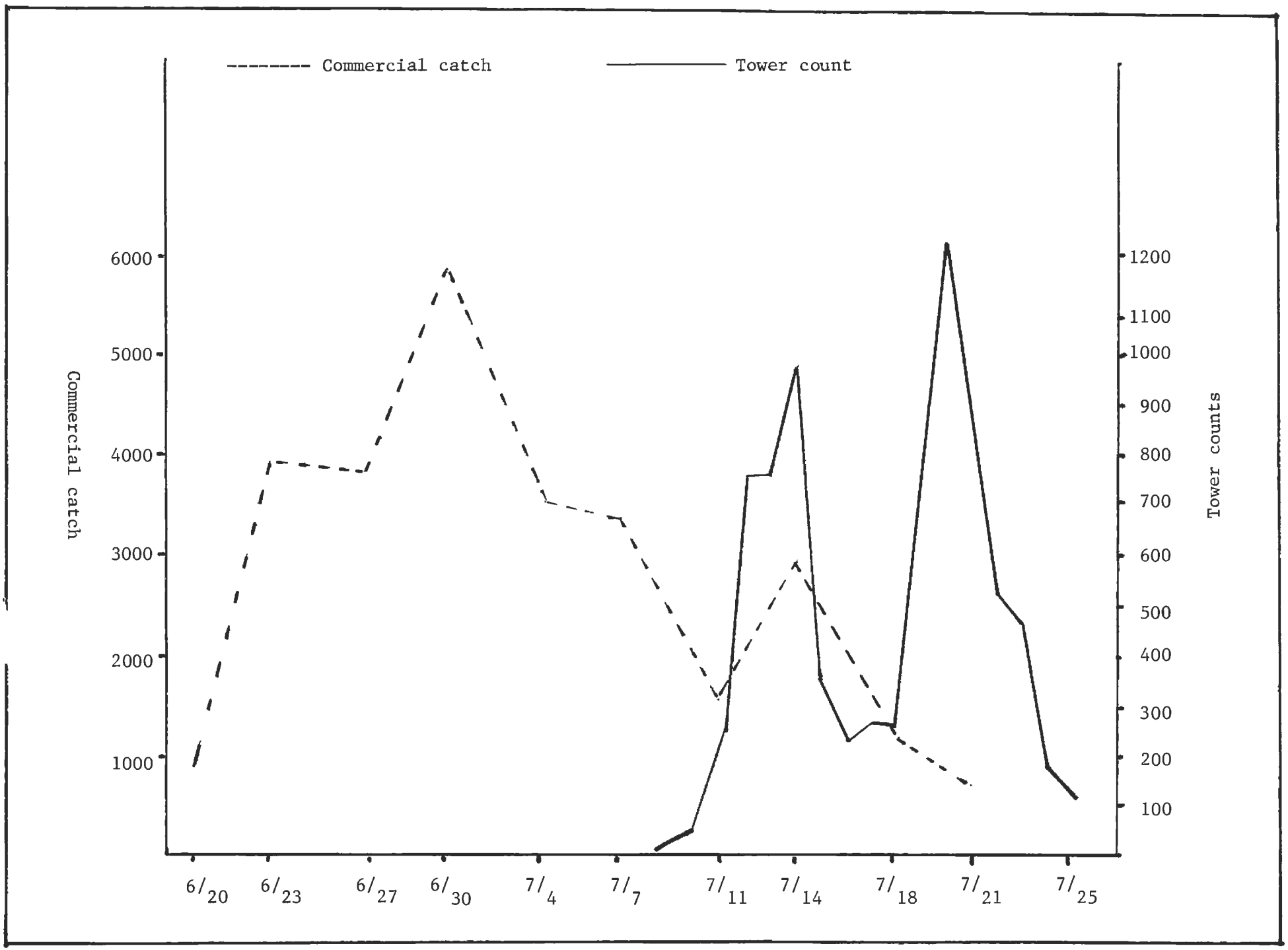

Figure 3. Comparison of Golovin Bay commercial fishery chum salmon catches and Niukluk River counting tower chum salmon counts, 1979.

Table 1 Cumulative daily total salmon escapement and percent of escapement past Niukluk River counting tower, 1978.

Date	CHUM SALMON		PINK SALMON	
	Number of Salmon	% of Total	Number of Salmon	% of Total
7/9	15	.2	15	.1
7/10	92	1.1	34	.2
7/11	312	3.8	315	1.1
7/12	1078	13.1	976	3.3
7/13	1866	22.7	1724	5.9
7/14	2857	35.0	3481	12.0
7/15	3227	39.3	6401	22.0
7/16	3453	42.0	7689	26.4
7/17	3720	45.3	8744	30.0
7/18	3986	48.5	10057	34.5
7/19	4686	57.0	13445	46.2
7/20	5936	72.3	17659	60.7
7/21	6782	82.6	27028	75.7
7/22	7318	89.1	26310	90.4
7/23	7790	94.8	27546	94.6
7/24	7977	97.1	28301	97.3
7/25	8091	98.5	28704	98.6
7/26	8197	99.8	29087	99.9
7/27	8213	100.0	29100	100.0

Table 2 Daily/Hourly salmon migration past Niukluk River counting tower, 1979. Species: CHUM

Hour/ Date	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Daily Total	% Daily Total
7/9	-	-	-	-	-	-	-	-	-	-	-	-	0	0	3	0	8	4	-	-	-	-	-	-	-	15	0.2
7/10	-	-	-	-	-	-	-	-	-	-	3	5	2	2	13	19	33	-	-	-	-	-	-	-	-	77	0.9
7/11	-	-	-	-	-	-	-	-	-	-	-	-	4	6	10	9	6	17	3	26	31	44	44	20	-	220	2.7
7/12	13	25	31	10	28	22	-	-	-	-	-	-	4	10	7	16	42	73	258	93	44	40	19	31	-	766	9.3
7/13	12	16	21	7	14	27	-	-	-	-	-	-	1	6	18	49	97	102	228	99	47	21	8	15	-	788	9.6
7/14	24	11	11	20	31	12	-	-	-	-	-	-	5	3	0	98	134	254	172	134	46	14	14	8	-	991	12.1
7/15	11	19	8	4	4	4	-	-	-	-	-	-	6	3	9	16	39	49	67	57	57	7	7	3	-	370	4.5
7/16	8	14	14	8	12	13	-	-	-	-	-	-	-4	5	4	14	21	20	27	35	11	8	9	7	-	226	2.7
7/17	5	8	18	14	2	12	-	-	-	-	-	-	3	11	11	25	29	5	20	44	15	13	9	23	-	267	3.3
7/18	2	4	4	8	7	12	-	-	-	-	-	-	-3	11	10	9	6	8	45	53	43	18	19	10	-	266	3.2
7/19	3	7	6	1	3	5	-	-	-	-	-	-	8	6	43	12	54	107	93	146	81	40	58	27	-	700	8.5
7/20	11	10	14	17	10	5	-	-	-	-	-	-	76	36	56	62	88	268	148	67	172	105	61	44	-	1250	15.3
7/21	24	14	10	12	17	13	-	-	-	-	-	-	41	39	39	73	106	129	131	74	48	30	18	28	-	846	10.3
7/22	14	17	8	9	15	10	-	-	-	-	-	-	7	13	19	56	100	92	41	46	33	26	23	7	-	536	6.5
7/23	9	20	21	12	10	3	-	-	-	-	-	-	14	15	15	39	87	75	61	24	20	17	18	12	-	472	5.7
7/24	-	-	-	-	-	-	-	-	-	-	-	-	10	7	16	31	32	11	16	10	12	4	18	20	-	187	2.3
7/25	-	-	-	-	-	-	-	-	-	-	-	-	18	9	9	14	-9	7	11	7	24	8	11	5	-	114	1.4
7/26	-4	-7	6	6	6	10	-	-	-	-	-	-	4	7	7	1	-4	18	8	14	4	13	5	12	-	106	1.3
7/27	-11	6	4	7	3	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	16	0.2
Hourly Totals	121	164	176	135	162	156	-	-	-	-	3	5	195	189	289	543	869	1239	1329	929	688	408	341	272		8213	
% of Hourly Totals	1.5	2.0	2.1	1.6	2.0	1.9	-	-	-	-	0.1	0.1	2.4	2.3	3.5	6.6	10.6	15.1	16.2	11.3	8.4	4.9	4.1	3.3			100%

Table 3 Daily/Hourly salmon migration past Niukluk River salmon counting tower, 1978. Species: PINK

Hour/ Date	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Daily Total	% Daily Total
7/9	-	-	-	-	-	-	-	-	-	-	-	-	0	0	6	8	1	0	-	-	-	-	-	-	15	.05
7/10	-	-	-	-	-	-	-	-	-	-	-	-	0	3	0	3	0	10	3	-	-	-	-	-	19	.05
7/11	-	-	-	-	-	-	-	-	-	-	-	-	5	3	7	10	0	23	4	33	31	28	86	51	281	.96
7/12	4	15	77	34	19	26	-	-	-	-	-	-	14	23	15	28	57	90	36	88	37	50	32	16	661	2.3
7/13	6	13	22	14	23	24	-	-	-	-	-	-	13	28	24	77	88	85	70	80	64	30	46	41	748	2.6
7/14	34	41	22	19	25	4	-	-	-	-	-	-	-2	0	36	182	148	94	227	564	209	33	69	52	1757	6.0
7/15	21	41	34	7	6	8	-	-	-	-	-	-	44	24	73	101	178	433	593	877	348	33	68	31	2920	10.0
7/16	46	6	1	5	20	4	-	-	-	-	-	-	20	70	97	121	89	164	134	182	129	83	90	27	1288	4.4
7/17	12	-11	29	27	5	10	-	-	-	-	-	-	-10	77	143	110	170	18	79	147	79	72	24	64	1055	3.6
7/18	10	-4	-8	-11	9	-7	-	-	-	-	-	-	24	58	71	22	35	61	156	354	373	118	31	21	1313	4.5
7/19	5	-62	20	11	-17	6	-	-	-	-	-	-	43	34	140	93	318	451	563	784	667	149	120	63	3388	11.6
7/20	33	31	36	26	46	68	-	-	-	-	-	-	143	159	129	335	410	808	752	533	303	175	127	100	4214	14.6
7/21	52	44	27	74	27	56	-	-	-	-	-	-	33	123	115	385	618	871	823	593	134	134	73	195	4367	15.1
7/22	37	59	30	4	23	20	-	-	-	-	-	-	87	75	193	487	386	635	796	526	548	153	137	88	4284	14.7
7/23	44	35	33	-3	2	8	-	-	-	-	-	-	34	26	88	115	246	157	106	101	68	54	42	80	1236	4.2
7/24	-	-	-	-	-	-	-	-	-	-	-	-	15	25	50	70	71	178	63	56	106	24	48	49	755	2.6
7/25	-	-	-	-	-	-	-	-	-	-	-	-	47	21	43	29	-31	24	34	34	51	59	56	36	403	1.4
7/26	-22	-10	5	10	6	33	-	-	-	-	-	-	35	57	46	15	31	29	35	24	15	13	22	39	383	1.3
7/27	-19	-8	3	18	9	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13	.04
Hourly Totals	263	190	331	235	203	270	-	-	-	-	-	3	545	806	1276	2198	2818	4121	4471	4976	3162	1208	1071	953	29100	
% of Hourly Totals	.9	.6	1.4	.8	.7	.9	-	-	-	-	-	.01	1.8	2.7	4.4	7.5	9.7	14.2	15.4	17.1	10.8	4.1	3.7	3.3		100.0

Table 4 Estimates of daily salmon migration past Niukluk River tower, using expanded 10 minute counts, Niukluk River, 1979.

	CHUM SALMON			PINK SALMON		
Date	10 minute Counts	Expanded[1] 10 minute Counts	Actual Counts	10 minute Counts	Expanded[1] 10 minute Counts	Actual Counts
7/9	2	12	15	4	24	15
7/10	7	42	77	4	24	19
7/11	58	348	220	67	402	281
7/12	134	804	766	83	498	661
7/13	143	858	788	112	672	748
7/14	155	930	991	293	1758	1757
7/15	92	552	370	689	4134	2920
7/16	26	156	226	183	1098	1288
7/17	44	264	267	87	522	1055
7/18	35	210	266	64	384	1313
7/19	93	558	700	605	3630	3388
7/20	161	966	1250	713	4278	4214
7/21	143	858	846	762	4572	4367
7/22	92	552	536	718	4308	4284
7/23	98	588	472	222	1332	1236
7/24	38	228	187	112	672	755
7/25	20	120	114	61	366	403
7/26	12	72	106	69	414	383
7/27	1	6	16	2	12	13
Totals	1354	8124	8213	4850	29100	29100

[1] Expanded to 18 hour count

Table 5 Period and cumulative commercial fishery salmon catch and CPUE; Subdistrict 2, Golovin, 1979.

	CHUM SALMON				PINK SALMON			
Date	Daily	CPUE	Cumulative	CPUE	Daily	CPUE	Cumulative	CPUE
6/14-6/16	582		582		94		94	
6/18-6/20	958	1.7	1540	1.9	390	.7	484	1.7
6/21-6/23	3905	4.8	5445	3.3	3031	3.1	3515	2.2
6/25-6/27	3829	4.7	9274	3.8	6658	8.2	10173	4.2
6/28-6/30	5775	6.2	15099	4.4	6874	7.2	17047	5.0
7/02-7/04	3558	4.1	18607	4.4	7787	9.0	24839	5.8
7/05-7/07	3457	4.0	22064	4.3	7405	8.6	32244	6.3
7/09-7/11	1591	2.8	23655	4.1	443	.8	32687	5.7
7/12-7/14	2889	3.3	26544	4.0	8168	9.4	40855	6.2
7/16-7/18	1215	.6	27759	3.8	2610	3.4	43565	5.9
7/19-7/21	747	1.2	28506	3.6	1287	2.1	44752	5.6
7/23-7/25	618	1.3	29124	3.5	651	1.4	45408	5.4
7/26-7/28	498	1.0	29622	3.3	189	.4	45597	5.1
7/30-8/01	341	.6	29963	3.1	194	.3	45791	4.8
8/02-8/04	130	.3	30122	3.0	35	.1	45826	4.6